

Accepted Manuscript

Original article

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PII: S1319-562X(16)30192-9

DOI: <http://dx.doi.org/10.1016/j.sjbs.2016.12.016>

Reference: SJBS 838

To appear in: *Saudi Journal of Biological Sciences*

Received Date: 16 November 2016

Revised Date: 17 December 2016

Accepted Date: 18 December 2016

Please cite this article as: S. Ge, Z. Liu, Y. Furuta, W. Peng, Characteristics of Activated Carbon Remove Sulfur Particles against Smog, *Saudi Journal of Biological Sciences* (2016), doi: <http://dx.doi.org/10.1016/j.sjbs.2016.12.016>

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Characteristics of Activated Carbon Remove Sulfur Particles against Smog

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Abstract Sulfur particles, which could cause diseases, were the main powder of smog. And activated carbon had the very adsorption characteristics. Therefore, five sulfur particles were adsorbed by activated carbon and were analyzed by FT-IR. The optimal adsorption time were 120 min of Na₂SO₃, 120 min of Na₂S₂O₈, 120 min of Na₂SO₄, 120 min of Fe₂(SO₄)₃ and 120 min of S. FT-IR spectra showed that activated carbon had the eight characteristic absorption of S-S stretch, H₂O stretch, O-H stretch, -C-H stretch, conjugated C=O stretch or C=C stretch, CH₂ bend, C-O stretch and acetylenic C-H bend vibrations at 3850 cm⁻¹, 3740 cm⁻¹, 3430 cm⁻¹, 2920 cm⁻¹, 1630 cm⁻¹, 1390 cm⁻¹, 1110 cm⁻¹ and 600 cm⁻¹, respectively. For Na₂SO₃, the peaks at 2920 cm⁻¹, 1630 cm⁻¹, 1390 cm⁻¹ and 1110 cm⁻¹ achieved the maximum at 20 min. For Na₂S₂O₈, the peaks at 3850 cm⁻¹, 3740 cm⁻¹ and 2920 cm⁻¹ achieved the maximum at 60 min. the peaks at 1390 cm⁻¹, 1110 cm⁻¹ and 600 cm⁻¹ achieved the maximum at 40 min. For Na₂SO₄, the peaks at 3430 cm⁻¹, 2920 cm⁻¹, 1630 cm⁻¹, 1390 cm⁻¹, 1110 cm⁻¹ and 600 cm⁻¹ achieved the maximum at 60 min. For Fe₂(SO₄)₃, the peaks at 1390 cm⁻¹, 1110 cm⁻¹ and 600 cm⁻¹ achieved the maximum at 20 min. For S, the peaks at 1630 cm⁻¹, 1390 cm⁻¹ and 600 cm⁻¹ achieved the maximum at 120 min. It provided that activated carbon could remove sulfur particles from smog air to restrain many anaphylactic disease.

KEYWORDS Activated carbon; Desulfuration; Na₂SO₃; Na₂S₂O₈; Na₂SO₄; Fe₂(SO₄)₃; S

1. Introduction

Sulfur powder, is solid at room temperature, mainly from the exploitation of natural gas, oil and natural sulfur mine. Reactive sulfur in general, it can burn to sulfur dioxide, mixing with oxidants may explode, can react with the alkali metal (Zhang, 2010). An association between high levels of air pollutants and human disease has been known for more than half a century. Air pollution is composed of a heterogeneous mixture of compounds including ozone (O₃), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), liquids, and particulate matter (PM). Substantial epidemiological evidence implicates air pollution, particularly sulfur dioxide (SO₂) and PM, as a major risk factor with serious consequences on human health (Ahmadpour *et al.* 1996; Chandra *et al.* 2009; Jumariah *et al.* 2005). Of particular interest in PM are the particles that are ≤10 μm in diameter (PM₁₀) because they are the PM that ultimately enters the lungs. Which may make the person allergic and sick. Globally, the number of people receiving TB therapy grew to 5.4 million in 2013, from 1.0 million enrolled in the DOTS (directly observed treatment, short-course) programme in 1995 (Yuan, 2004). Sulfur powder and sulfur dioxide (SO₂) often floated in air. If which was inhaled in vivo, it could cause diseases.

Activated carbon can use almost any type of carbon materials, such as wood (Zhang, 2010), sawdust, coal (Ding, 2002), shells (Yu, 2005), the stone of the fruit, bagasse, oil waste, waste plastics (Peng, 2014a), paper and leather scrap (Peng, 2013a), waste tires, urban waste, etc (Xiao, 2013). Activated carbon with highly developed porous structure and huge specific surface area (Peng, 2013b), good chemical stability and thermal stability, high mechanical strength and surface contains a variety of oxygen containing functional groups (Wang, 2013; Peng, 2013c). What's more, activated carbon, which contained potassium, calcium and other minerals, could have adsorption and filtration of extractives, oil, sulfur-based compounds, other matters (Liu *et al.* 2008; Zhang *et al.* 2008; Ling *et al.* 1999; Bautista-Toledo *et al.* 1994). Therefore, activated carbon has a strong adsorption, and at the same time can make high dispersed catalyst load system, and as a reducing agent to participate in the reaction, reduce the reaction temperature (Wang, 2009). Activated carbon adsorption method is simple, no secondary pollution, can be a very good adsorption of sulfide in the air (Lin *et al.* 2015; Peng *et al.* 2014b; Sun *et al.* 2014; Peng *et al.* 2015; Wang *et al.* 2009). That was beneficial for people's health. In order to figure out the optimal adsorb condition and the intrinsic change of the activated carbon, five chemicals were adsorbed by activated carbon and were analyzed by FT-IR.

2 Materials and Methods

2.1. Materials

Activated carbon, Na₂SO₃, Na₂S₂O₈, Na₂SO₄, Fe₂(SO₄)₃ and S were purchased from the market.

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